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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
SONG, HOON K	

ART UNIT	PAPER NUMBER
2882	

DATE MAILED: 06/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/625,361	EDIC ET AL.	
	Examiner	Art Unit	
	Hoon Song	2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 March 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-55* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-17,21-32,36-51 and 55* is/are rejected.

7)☒ Claim(s) *18-20,33-35 and 52-54* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Allowable Subject Matter

The indicated allowability of claims 3, 7, 24, 25, 39 and 42 is withdrawn in view of the newly discovered reference(s) to Stergiopoulos (US 6535570B2) and Cabral et al. (US 6002738). Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-4, 7-9, 12-17, 21-32, 36-39, 42-44, 47-51 and 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stergiopoulos (US 6535570B2) in view of Cabral et al. (US 6002738).

Regarding claims 1, 3-4, 22, 24-25, 27, 37, 39 and 42, Stergiopoulos teaches a method and apparatus for reducing motion-related artifacts in a CT cardiac image, comprising:

acquiring a projection data set during one or more slow rotations or a partial rotation of a CT gantry about a heart, wherein the projection data set comprises a plurality of projections (column 5 line 14-15);

acquiring a phase data set for the heart from at least one of an ECG data set, an ultrasound image data set, a tagged MRI data set, and the projection data set (column 5 line 45+);

determining cardiac motion from the projection data set and the phase data set or from one or more images generated from the projection data set and the phase data set (column 6 line 38-40);

applying one or more reconstruction grids based upon the determined cardiac motion, wherein each reconstruction grid is associated with a view angle; and backprojecting a corresponding projection onto a respective reconstruction grid for all view angles to generate a motion corrected image, wherein the corresponding projection comprises the projection acquired at the respective view angle associated with the reconstruction grid (column 12 line 34-38).

However Stergiopoulos fails to teach that the reconstruction grid is warped reconstruction grid.

Cabral teaches a CT reconstruction using warped reconstruction grid.

It would have been obvious to one of ordinary skill in the art at the time of the invention to adapt the CT reconstruction of Stergiopoulos with the warped reconstruction as taught by Cabral, since the warped reconstruction would further reduce any artifact due to fan beam constraints.

Regarding claims 2, 23 and 38, Stergiopoulos teaches the dynamic object is a heart (figure 2).

Regarding claims 8, 26 and 43, Stergiopoulos teaches associating the motion-corrected images spatially, temporally, or spatially and temporally (column 5 line 51-52).

Regarding claims 9 and 44, Stergiopoulos teaches the projection data set is acquired during one slow rotation of The CT gantry (figure 2).

Regarding claims 12 and 27, Stergiopoulos teaches the phase data set is acquired from consistency condition moments of the projection data set (column 5 line 14-15).

Regarding claims 13, 28 and 47, Stergiopoulos teaches determining cardiac motion, comprises: reconstructing a phase-specific image for each phase of interest for the phase of interest wherein determining motion between temporally adjacent phase-specific images.

However Stergiopoulos fails to teach wherein the projection set comprises the projection data set with projections corresponding to the phase of interest weighted higher.

Cabral teaches weighed tomographic reconstruction.

It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the reconstruction method of Stergiopoulos with the weighed reconstruction method as taught by Cabral, since the weighed reconstruction method would further reduce any artifact due to constraint of using the fan beam.

Regarding claims 14, 29 and 48, Stergiopoulos teaches the phase-specific image is reconstructed iteratively (column 5 line 45+).

Regarding claims 15, 30 and 49, Stergiopoulos teaches iteratively reconstructing the phase-specific image uses a non-time resolved reconstruction to facilitate iterative computation of one or more temporally varying regions in the phase-specific image (column 15 line 55+).

Regarding claims 16, 31 and 50, Stergiopoulos teaches determining cardiac motion, comprises: reconstructing two or more time-resolved images using the projection data set and the phase data set; and correlating the location of one or more regions of interest in the two or more time-resolved images to generate a respective image displacement map for each pair of time-resolved images (column 5 line 45+).

Regarding claims 17, 32 and 51 Stergiopoulos teaches determining whether the correlation of the locations of the regions of interest exceeds a correlation threshold for each image displacement map; and subdividing the region of interest and updating the displacement maps until the correlation threshold is exceeded (column 5 line 45+).

Regarding claims 21, 36 and 55, Stergiopoulos teaches the determining cardiac motion identifies one or more view angles corresponding to a cardiac phase, subtracts the projection data acquired at the next adjacent views from the respective projection data acquired at the view angles to generate one or more respective differential signals for the cardiac phase, and generates motion data from the one or more respective differential signals for the remaining phases of interest (column 6 line 30-35).

Claims 1, 3-4, 22, 24-25, 27, 37, 39 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Davantes et al. (US 6252924B1) in view of Cabral et al. (US 6002738).

Regarding claims 1, 3-4, 22, 24-25, 27, 37, 39 and 42, Davantes teaches a method and apparatus for reducing motion-related artifacts in a CT cardiac image, comprising:

acquiring a projection data set during one or more slow rotations or a partial rotation of a CT gantry about a heart, wherein the projection data set comprises a plurality of projections (column 3 line 9 and column 4 line 8);

acquiring a phase data set for the heart from at least one of an ECG data set, an ultrasound image data set, a tagged MRI data set, and the projection data set (column 3 line 47-51, 56-58)

determining cardiac motion from the projection data set and the phase data set or from one or more images generated from the projection data set and the phase data set (column 3 line 47-51, 56-58);

applying one or more reconstruction grids based upon the determined cardiac motion, wherein each reconstruction grid is associated with a view angle; and backprojecting a corresponding projection onto a respective reconstruction grid for all view angles to generate a motion corrected image, wherein the corresponding projection comprises the projection acquired at the respective view angle associated with the reconstruction grid (column 3 line 67 – column 4 line 1).

However Davantes fails to teach that the reconstruction grid is warped reconstruction grid.

Cabral teaches a CT reconstruction using warped reconstruction grid.

It would have been obvious to one of ordinary skill in the art at the time of the invention to adapt the CT reconstruction of Davantes with the warped reconstruction as taught by Cabral, since the warped reconstruction would further reduce any artifact due to fan beam constraints.

Claims 5-6, 10-11, 40-41 and 45-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stergiopoulos as modified by Cobral as applied to claims 1, 7, 22, 25, 37 and 42 above, and further in view of Stonestrom (US 4284896).

Regarding claim 5-6, 10-11, 40-41 and 45-46, Stergiopoulos fails to teach the one or more slow rotations or the partial rotation take approximately fifteen seconds per rotation.

Stonestrom teaches a rotation speed of fifteen second (column 2 line 42).

It would have been obvious to one of ordinary skill in the art at the time of the invention to adapt CT system of Stergiopoulos with the rotation speed as taught by Stonestrom, since the rotation speed of Stonestrom would reduce mechanical constraint of fast gantry rotation while providing sufficient time to collect imaging data to reconstruct the image.

Allowable Subject Matter

Claims 18-20, 33-35 and 52-54 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claims 18-19, 33-34 and 52-53, the prior art fails to teach determining cardiac motion, comprises: reconstructing two or more phase-specific images using the projection data set and the phase data set; decomposing one or more regions of interest in the two or more phase-specific images to generate wavelet coefficients of the regions of interest; and analyzing the differences between the wavelet coefficients to generate a respective image displacement map for

each pair of time-resolved images as claimed in dependent claims 18, 33 and 52.

Regarding claims 20, 35 and 54, the prior art fails to teach determining cardiac motion, comprises: reconstructing a time-resolved image at the phase of minimum motion using the projection data set and the phase data set; identifying one or more view angles associated with the next adjacent phase; forward-projecting the time-resolved image at the identified view angles to generate a set of forward projected data; minimizing the difference between the forward projected data and the projection data set to generate a set of phase-specific displacement data; reconstructing a phase-specific image at the next phase using the phase-specific displacement data; and generating a set of phase-specific displacement data for the phase-specific image at the next phase and for the remaining phases of interest as claimed in dependent claims 20, 35 and 54.

Response to Arguments

Applicant's arguments with respect to claims 1-55 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hoon Song whose telephone number is (571) 272-2494. The examiner can normally be reached on 8:30 AM - 5 PM, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571) 272 - 2490. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

HKS 5/22/05
HKS

DAVID V. BRUCE
PRIMARY EXAMINER